HINGE APPARATUS AND ELECTRONIC DEVICE COMPRISING IT

This application claims priority to Chinese patent application No. CN 201210046879.4 filed on Feb. 27, 2012, the entire contents of which is incorporated herein by reference.

The present invention generally relates to a hinge apparatus, and more particularly to a hinge apparatus with a flexible shaft effect and an electronic device comprising the hinge apparatus.

BACKGROUND

Portable electronic devices, such as notebook computers, mobile phones, personal digital assistants (PDA) and digital media players and so on have been widely used in people's daily lives. Therefore, users also have increasing demands on such electronic devices. Many users hope that portable electronic devices are waterproof and dustproof and are adapt to the needs of a variety of environments. The processor of the electronic device can have no cooling hole after advancing into the low power era. However, the hinge connecting portion of the electronic device still cannot be seamless.

On the other hand, users have multiple usage requirements, requiring electronic products, such as notebook computers, to provide a 360-degree rotation and stay in any position to achieve a variety of usage patterns. However, the hinge apparatus in the prior art cannot make the screen portion and the keyboard portion of the notebook computers, for example, in the same plane.

Therefore, there is a need for a hinge apparatus, which can solve one or more of the above-mentioned problems or other problems in the prior art

SUMMARY

According to one aspect of the present invention, a hinge apparatus is provided, which can achieve a flexible shaft effect.

According to another aspect of the present invention a hinge apparatus is provided, which can achieve a seamless connection between two portions.

According to still another aspect of the present invention a hinge apparatus is provided, which can place the two portions connected by it in the same plane.

According to yet another aspect of the present invention a hinge apparatus is provided, which comprises any one of the foregoing hinge apparatuses.

According to one exemplary embodiment of the present invention, a hinge apparatus is provided, comprising: n shafts, arranged side by side, wherein n is an integer equal to or greater than 3; and multiple connecting elements, for rotatably connecting each two adjacent shafts so as to form a shaft chain.

Each connecting element can have two shaft holes and each two adjacent shafts can be nested into the two shaft holes respectively.

Each two adjacent shafts can be rotatably connected to each other through the connecting element at both ends of the shafts.

The hinge apparatus can comprise two or more shaft chains and the hinge apparatus can further comprise: at least one synchronization bridge, each of the synchronization bridge extending along the direction in parallel with the shaft and connecting the two shafts which are in adjacent two shaft chains respectively, so as to synchronize the rotation of the two shafts.

The shaft can provide a projection and the connecting element can provide a baffler, and the projection and the baffler can cooperate to limit the maximum rotation angle of the shaft with respect to the connecting element to a predetermined angle. The predetermined angle can be 180/(n−1) degrees.

The hinge apparatus can further comprise a fixed connecting element, provided on the two outermost shafts of the shaft chain to fixedly connect to external parts to be connected by the hinge.

The hinge apparatus can further comprise a soft covering material to cover the shaft chain.

According to another exemplary embodiment, an electronic device can comprise a first body, a second body, and a hinge apparatus connecting the first body and the second body, the hinge apparatus comprising: n shafts, arranged side by side, wherein n is an integer equal to or greater than 3; multiple connecting elements, for rotatably connecting each two adjacent shafts so as to form a shaft chain.

Each connecting element can have two shaft holes and each two adjacent shafts are nested into the two shaft holes respectively.

Each two adjacent shafts can be rotatably connected to each other through the connecting element at both ends of the shafts.

The hinge apparatus can comprise two shaft chains and the hinge apparatus can further comprise: at least one synchronization bridge, each of the synchronization bridge extending along the direction in parallel with the shaft and connecting the two shafts which are in adjacent two shaft chains respectively, so as to synchronize the rotation of the two shafts.

The shaft can provide a projection and the connecting element can provide a baffler, and the projection and the baffler can cooperate to limit the maximum rotation angle of the shaft with respect to the connecting element to a predetermined angle. The predetermined angle can be 180/(n−1) degrees. The baffler can be symmetrical with respect to the line of the center of the two shaft holes.

The hinge apparatus can further comprise: a fixed connecting element, provided on the two outermost shafts of the shaft chain to fixedly connect to the first body and the second body respectively.

The hinge apparatus can further comprise: a soft covering material, to cover the shaft chain and the connection between the shaft chain and the first body or the second body, so as to form a seamless connection.

The hinge apparatus of the present invention achieves a flexible shaft effect by connecting multiple shafts to form shaft chains, and the hinge apparatus can also place the two bodies connected by it in the same plane to implement a seamless connection between the two bodies.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects of an embodiment of the present invention become apparent from below with reference to the detailed description of the drawings, in the drawings:

FIG. **1** shows a hinge apparatus according to an exemplary embodiment of the present invention;

FIG. **2** is an enlarged view showing the mutual connection between the shafts of the hinge apparatus;

FIG. **3** is an enlarged view showing the connection between the shaft and the connecting element in a hinge apparatus according to another embodiment;